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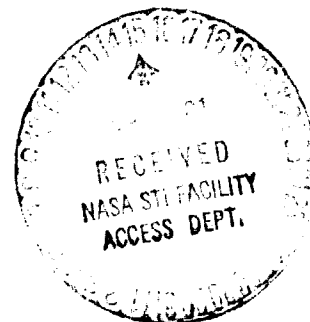
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PROGRAM FOR THE MEDICAL EXAMINATION (CONSULTATION)
OF COSMONAUTS

N.M. Rudnyy, O.G. Gazenko, A.V. Beregovkin,
T.N. Krupina

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16. Abstract This article outlines the medical selection process used to screen cosmonaut candidates. The various stages of selection are discussed, and the specific types of medical examinations are described. Various criteria used for selection are presented.					
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A PROGRAM FOR THE MEDICAL EXAMINATION
(CONSULTATION) OF COSMONAUTS

N. M. Rudnyy, O. G. Gzenko, A. V. Beregovkin
T. N. Krupina*

1.0. General position

Success in the professional activity of crews aboard spacecraft is determined in considerable degree by the quality of medical selection. Medical requirements for the health state of candidates for cosmonaut presuppose good health and high functional capabilities of the organism, which is dictated by the cosmonauts' professional duties.

Candidates for cosmonaut are selected from among volunteers from flight personnel and specialists in other various professions (engineers, doctors and others) ranging in age from 25 to 45 years.

For the entire duration of their training, during the process of space flight, and after its completion, the cosmonauts are under the constant control of medical specialists.

2.0. Problems of selection

The requirements for the health state of candidates for cosmonaut are based on the experience of clinical medicine, the experience of medical-

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flight examinations, and the data from experimental studies on the effect of factors of space flight on the human organism.

The following problems are solved in the process of medical selection:

- an evaluation of the health state and the functional capabilities of the candidate's organism for special training and participation in space flight;

- the clarification of psychological and professional personality specifics and the character of the organism's physiological reactions to functional tests for the purpose of developing individual training plans for space flight.

3.0. Stages of selection

The physical examination of candidates is conducted in three stages:

- the first selection of candidates is conducted by examining physicians in an outpatient clinic (polyclinical stage of selection);

- consulting and examining the candidates selected in stage I in a hospital at a specialized clinical institution (stage II);

- candidates selected in stage II are screened during the process of training and special preparation at the Yu. A. Gagarin Center for Cosmonaut Training (stage III).

At the I and II stages of selection, questions concerning the candidate's suitability are decided by a commission of examining physicians. The decisions of this commission are confirmed by the Chief Medical Commission of the USSR, which is the highest organ for the physical examination of cosmonauts and cosmonaut candidates. Included in this commission are the leading specialists in clinical and space medicine in the USSR.

3.1. Primary stage of selection.

The preliminary medical examination of candidates for cosmonaut is conducted under outpatient conditions by examining physicians conducting the physical examination (therapist, neuropathologist, oculist, otorhinolaryngologist, surgeon and others). Case history data is clarified, hereditary data is gathered, and medical records are studied. A number of clinical-physiological methods are used which may point out a pathology which may exclude the candidate from further participation in the examination program.

At this stage of selection, the commission of examining physicians makes the following decisions:

- the candidate is suitable for hospital examination;
- the candidate is unsuitable for hospital examination.

3.2. The second stage of selection.

The main purpose for hospital examination and consultation is to determine any hidden pathology, early pre-clinical forms of illnesses, as well as to determine the functional capabilities of the organism and its individual systems. The hospital stage of selection, as a rule, is limited to the following methodologies and scope of studies.

3.2.1. Methodologies and scope of medical examinations at stage II of selection.

3.2.1.1. Examination of the internal organs.

a) an in-depth, goal-oriented study of the case history to exclude paroxysmal disorders in consciousness, attacks of stenocardia, renal, hepatic, intestinal colic, etc.;

b) a physical examination;

c) special examination methods:

- roentgenography of the chest organs, roentgenoscopy of the stomach and the duodenum, when indicated -- gastro- and duodenoscopy;
- electrocardiography with 12 leads and at rest according to Nebo;
- spirometry

d) laboratory tests:

- blood: general analysis, number of thrombocytes, eosinophiles, reticulocytes, blood coagulation time and hemorrhage time, Wasserman reaction; a determination of: cholesterol, lipoproteins, lipoprotein lipase, lecithin, bilirubin, transaminase, aldolase, alkaline phosphatase, residual nitrogen, prothrombin, protein and protein fractions, Rh-factor, C-reactive protein, folic acid, seromucoid, antistreptolysin-C titer, antihyaluronidase; thymol-veronal test, sedimentation reaction, galactose test;
- urine: general analysis, including: specific weight, pH, bile, number of leukocytes, presence of cast, protein, sugar, acetone, blood, and diastase;
- stool: general analysis, reaction for occult blood and triple testing for helminth eggs and protozoans;
- a fractional study of stomach secretions.

3.2.1.2. Neurological examination.

a) a study of case history data on the health state and professional work capacity. Syncopic collaptoidal or other paroxysmal consciousness disorders are excluded;

b) specifics of upper neural activity are discovered (on the basis of studying the case history, professional and medical descriptions, as well as the results of observation and examination);

c) neurological status -- determining the condition of the motor, coordination, sensory, and reflex function of the nervous system, the condition of the vegetative nervous system (vegetative reflexes, skin thermotopometry, a study of vascular innervation, capillary resistance, electrodermal resistance).

d) additional examination methods: reontgenography of the skull, the cervical and upper thoracic segments of the vertebral column, electroencephalography and rheoencephalography.

3.2.1.3. Psychological testing.

The thematic apperception test (TAT), the G. Lising questionnaire, the method of "unfinished sentences", the "frustration test" of S. Rozentsveyg, the Raven method, "the scale of reactive and personality anxiety" (Ch. Spilberger's method), Zh. Taylor's "anxiety" scale, Ya. Strelyau's questionnaire, the "SAN" method, the MMPI multi-profile questionnaire, the methodology of 16-factor personality analysis (modified method of H. Kettel), the "correction test" method, the "black-red table" method, the "o-sort" test, "homeostatic methodology", "word association test", "test with lidor", a quick method for determining the level of emotional stress on a "mirror coordinograph" device", are all used.

3.2.1.4. Surgical examination.

a) a study of case history data on past illnesses, traumas, and operative procedures;

b) an external examination;

c) the state of the lymphatic system, the prostate gland, the bones of the skull, the body, the spine, the extremities, and the peripheral vessels;

d) examination and palpation of the abdomen, the genitals and perineum;

d) a finger probe of the rectum, rectoromanoscopy;

e) additional methods of examination are general roentgenography of the urinary tract (kidneys, ureters, urinary bladder), roentgenography of the entire vertebral column in two projections; here the roentgenogram of the urinary tract is used for describing the lumbosacral area of the vertebral column in a straight projection.

3.2.1.5. Ophthalmological examination.

a) determination of the state of the sight organ function, examination of color perception using V. B. Nabkin's polychromatic tables, determination of visual acuity by isolated letter symbols, examination of the oculomotor apparatus and binocular vision, examination of fields of vision and determination of refractions;

b) a clinical examination of the sight organ -- an external examination of the eyes and adnexa, a colored nasolacrimal probe, biomicroscopy with the aid of a slit lamp with constricted and dilated pupils, ophthalmoscopy in direct and reverse form with dilated pupils, determination of intraocular pressure.

3.2.1.6. Otolaryngological examination.

a) investigation of complaints, building a case history;

b) exo- and endoscopy;

c) roentgenography of the nasal sinuses;

d) an examination of the function of LOR-organs; - nasal breathing and smell, barofunctions of the ear and nasal sinuses, the auditory function (by whispering, tonal and speech audiometry, in necessary cases with tuning forks), the vestibular function (see pp. 11, section III).

3.2.1.7. Stomatological examination.

A full stomatological examination is conducted, with orthopantomography, electro-odontodiagnosis, and extensive stomatoscopy.

3.2.1.8. Functional examinations.

1. Examination in a pressure chamber to determine endurance of moderate degrees of hypoxia ("altitude" 5000 m, exposure 30 min.) with a recording of the EKG and arterial pressure, overfalls in barometric air pressure -- the "dive" test (speed of descent from an "altitude" of 5000 m is 40-45 m/sec) to determine the barofunction of the ears and the nasal sinuses.

2. Orthostatic and anti-orthostatic tests with simultaneous recording of the EKG, regional rheograms, mechanocardiograms, cardiac output, and arterial pressure.

3. Testing with the effect of step-increasing ODNT (-25 mm Hg column, 2 min; -35 mm Hg column, 3 min; -45 mm Hg column, 5 min; -50 mm Hg column, 5 min).

4. Physical load (submaximal) on a bicycle ergometer in a continuously step-increasing regime (beginning physical load for women is 300 kgm/min; for men 450 kgm/min; additional load every 3 minutes is 150 kgm/min. The duration of the entire load is up to 12-15 minutes). Pulmonary function was studied (VLC, FVLC, V_{O_2} , V_{CO_2} , V_I) electrocardiography during the time of load according to Nebo (before and after 6 min. of the recovery period also with 12 leads), systolic and diastolic blood pressure.

5. Recording the EKG with synchronic recording of the AEC with functional tests (rhythmic photostimulation at 6-26 Hz, pulmonary hyper-ventilation for 5 min, inhaling an oxygen-poor gas mixture, turning the head to the side and tipping it back, alternate 2-min. pressure on the main carotid artery).

6. Oscillography or rheography of the brachial and crur arteries.

7. Capillaroscopy.

8. Nesterov's test.

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9. Examination of the function of the vestibular apparatus on Khilov's swing, and with cumulative effect of Coriolis for accelerations with a recording of the basic hemodynamic indicators.

3.2.1.9. Criteria for evaluating functional tests.

1. The study of the stability to change in body position is conducted with the aid of a 20-minute passive orthostatic test ($+70^\circ$). During the test, the EKG is recorded with 12 leads and hemodynamics is studied by the method of mechanocardiography (according to Savitskiy), or arterial pressure is recorded according to Korotkov. An evaluation of test endurance should be conducted in accordance with the indicators presented in table 1.

Table 1

An evaluation of the endurance of passive orthostatic load.

Indicators	Endurance		
	good	satisfactory	poor
1	2	3	4
State of health	Sufficiently good	General state is good. May complain of insignificant fatigue or slight weakness.	Complaints of overall weakness, dizziness, hot flashes spreading throughout the body in waves. May be loss of consciousness and convulsions.
External appearance	Ordinary, sometimes an insignificant cyanosis of the fingers is observed.	Hyperhidrosis of the face, underarms, palms; facial skin covering may be pale, in individual cases external appearance may remain normal.	Pallor of the face, hyperhidrosis on the skin covering on the head, chest, palms, expressed reduction in muscle tone.

1	2	3	4
Respiration	Unchanged or with slight change in the direction of greater or lesser frequency	Unchanged or with slight change in the direction of greater or lesser frequency	Dyspnea, singular deep respiratory motions
Extreme systolic pressure	Usually somewhat reduced, remaining within the limits of normal values, more rarely observed is its increase	Moderately reduced, less than extreme systolic pressure	Markedly reduced
Lateral systolic pressure	Usually somewhat reduced, but in a lesser degree than extreme systolic pressure	Moderately reduced, less than extreme systolic pressure	Markedly reduced
Average dynamic pressure	Remains unchanged or rises slightly	Does not change or vascillates in the direction of increase or reduction	Drops (below 70 mm Hg column) or rises sharply (above 100 mm Hg column)
Diastolic pressure	rises somewhat, usually remaining within the limits or normal values	Does not change or vascillates in the direction of reduction or increase	becomes elevated or on the contrary becomes clearly reduced
Pulse pressure	Drops somewhat, remaining sufficiently high (above 30 mm Hg column).	Drops to 25-20 mm Hg column, in some cases with a drop in diastolic pressure it may be rather high	Drops markedly (less than 20 mm Hg column), sometimes in connection with a drop in diastolic pressure it may be quite high
Systolic volume (according to Brenzer-Sanke)	Reduced to 40-35 ml	Reduced to 35-25 ml	Reduced to 25 ml or below
Minute volume	Usually no less than 3 liters	Most often it is moderately reduced to 2.9-2.5 liters	Significantly reduced to 2.5 liters or below
Heartbeat rhythm	regular, more frequent than in background (80-90 beats per min, rarely may be faster or slower)	regular, considerably accelerated (over 100 beats in 1 min)	Expressed tachycardia, combined with a marked reduction in pulse pressure or with a drop in average dynamic pressure, in individual cases there may be auricular or ventricular extrasystoles, migration of the rhythm source.

1	2	3	4
T-wave	Changes in accordance with the position of the cardiac axis	Amplitude is reduced	Double phase or inversion appears, not conditioned by change in the position of the cardiac axis
Segment ST	Does not change	Does not change or is displaced insignificantly below the iso-line	Displacement of a pathological character

II. Determination of the organism's endurance of physical load is done on a bicycle ergometer. During the test, the EKG is recorded with 12 leads and the arterial pressure is measured according to Korotkov. An evaluation of the endurance of physical load should be conducted in accordance with the indicators presented in table 2.

Table 2

An evaluation of the endurance of dosed physical load on a bicycle ergometer

Indicators	Endurance		
	good	satisfactory	poor
1	2	3	4
State of health	Good	General condition is sufficiently good, may be complaints of fatigue	Complaints of weakness, fatigue, may be loss of consciousness
External appearance	Ordinary, sometimes a slight hyperhidrosis of the underarms	Moderate hyperhidrosis of the underarms, face, face becomes flushed	Considerable hyperhidrosis of the skin coverings of the head, chest, palms, face becomes pale, in individual case a reduction of the muscle tone
Respiration	Insignificant increase in frequency	Noticeable increase in frequency (up to 35-30)	Rapid, heavy breathing, dyspnea
Systolic pressure	Rises to 170-180 mm Hg column	Rises to 170-180 mm Hg column	Rises above 180 mm Hg column

1	2	3	4
Diastolic pressure	Does not change or increases by 10 mm Hg column	Increases by 15-20 mm Hg column	Increases by more than 20 mm Hg column
Cardiac contraction rhythm	Regular, speeds up to 160 beats in 1 min.	Regular, tachycardia up to 170 beats in 1 min., in individual cases -- singular extrasystoles	Tachycardia over 180 beats in 1 min., multiple group and polytopic extrasystole, migration of the rhythm source along the auricles and atrioventricular node
Atrioventricular and intra-ventricular conduction	Does not change or is reduced	Does not change	Slows down
T-wave	Is insignificantly increased or reduced, more rarely remains unchanged	Is significantly increased or reduced, sometimes becomes more compact	Becomes two-phase or inverted (inversion is not conditioned by a change in the axis of the heart); in individual cases -- gigantic waves are observed
Segment ST	Obliquely ascending displacement of no more than 1.5 mm	Displacement of a horizontal character up to 0.75 mm and obliquely ascending up to 2.0 mm with QX/QT index equal to or less than 50%	Displacement of a horizontal character over 0.75 mm and obliquely ascending over 2.5 mm

III. The stability of the vestibular apparatus to the effect of adequate irritants is determined with the aid of a number of vestibulometric tests, including the test on Khilov's parallel swings (for 15 minutes) and the endurance of cumulative effects of Coriolis accelerations by the methodology of interrupted and continuous effect for a period of 10 minutes. Other examination methods are also used for defining more precisely the character of vestibular reactions (caloric test, cupulometry, etc.).

Three degrees of sensitivity to vestibular irritants should be distinguished:

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a) the appearance of vestibular-vegetative reactions of the III degree (according to K. L. Khilov's classification) at any moment of the test or 10-15 min. thereafter is attributed to the sharply expressed degree of sensitivity to vestibular irritants (nausea, change in arterial pressure, noticeable pallor, perspiration, increased salivation, adynamia, the appearance of focal neurological symptoms, pre-collaptoid state, and others);

b) related to the moderate degree of increase in sensitivity to vestibular irritants is the appearance of vegetative reactions of the I-II degree at any moment of the test or 10-15 minutes thereafter (pallor of skin coverings, or quickly passing hyperemia, moderate hyperhidrosis, change in pulse rate by 10 beats per minute or less, etc.);

c) related to the weak degree of increase in sensitivity to vestibular irritants is the appearance of vegetative reactions of the I degree at individual moments of influence.

IV. Centrifuge test ("head-pelvis" - 5 units, 30 sec., "chest-back" - 8 units, 40 sec.).

V. Test with the effect of step-increased ODNT (duration 15 minutes) in the following regimes: -25 mm Hg column, 2 min., -35 mm Hg column, 3 min., -45 mm Hg column, 5 min., -50 mm Hg column, 5 min.

If necessary, the methodologies and scope of examinations indicated in section 3.2.1. may be widened.

The results of the examinations are entered into the clinical-physiological examination record.

On the basis of the hospital examination, the commission of examining physicians makes the following decisions:

- the candidate is suitable for special preparation and training;
- the candidate is not suitable, with an indication of the character of his illness or functional disorder;
- the candidate is temporarily unsuited (in cases where deviations found in the health state require short-term treatment, no longer than 1 month).

3.3. The third stage of selection (final examination).

The final clinical-physiological examination of candidates for cosmonaut is conducted in the process of preparing and training (them) at the Yu. A. Gagarin Center for Cosmonaut Training.

Candidates who have successfully passed the medical examination are presented once again for examination by the Chief Medical Commission during their preparation.

The Chief Medical Commission makes one of the following decisions:

- the candidate is suitable for participation in the space program;
- the candidate is temporarily unsuited for participation in the space program;
- the candidate is not suitable for participation in the space program.

4.0. Criteria for selection.

Candidates for cosmonaut and cosmonauts are deemed unsuitable if any of the following physical disorders or illnesses are discovered.

4.1. Psychical and nervous disorders:

- all forms of psychological illnesses and disorders;
- in individual cases, candidates for cosmonaut-researcher, after successful hospital treatment, with stable and full recovery of psychical functions, good endurance of functional load tests, high indicators on experimental psychological testing under ordinary and extreme conditions,

adequate behavior under complex life situations, may be judged suitable on an individual basis. However, the candidate may be deemed suitable no sooner than one year after recovery of psychical activity;

-- psychopathy, neuroses, reactive conditions whose diagnosis must be done in a treatment institution;

-- organic illnesses of the central nervous system of a progressive character or in the presence of stable and deep functional disruptions, as well as myopathy, myotonia, and myasthenia. Tumors, syringomyelia, McArdle syndrome, and other hereditary-degenerative diseases. Disruption of the cerebral circulation of the hematoma, thrombosis or embolism type, as well as dynamic disruptions of the cerebral circulation with temporary general and local functional disruptions. Clinically expressed forms of atherosclerosis of the cerebral arteries. Aftereffects of infections or intoxications of the central nervous system with residual effects in the form of stable and deep functional disruptions, as well as chronic forms of infectious illnesses of the central nervous system (neurosyphilis, encephalitis, leptomeningitis, multiple sclerosis, and others);

-- in candidates for cosmonaut-researcher in cases where there are insignificant residual effects without disruption of function after enduring infectious and intoxicational illnesses of the central nervous system, or when there are residual effects in the form of stable mono-symptoms which do not disrupt function, with good endurance of functional load tests and a normal EEG, the question of suitability is decided individually;

-- aftereffects of traumas to the brain and spinal cord manifested in psychical disorders, impairments to movement and sensitivity, and functions of the pelvic organs. Related to this are all cases of traumatic epilepsy. This point also applies to drawn-out post-traumatic asthenic conditions;

-- in candidates for cosmonaut researcher in cases where the residual manifestations after the trauma are insignificantly expressed, have a functional character and are manifested in the form of emotional and vascular-vegetative instability with good general state of health, with normal indicators of functional load tests during synchronous EEG and RKG tests, with good endurance of the ortho-test, vestibulometric effect, experimental-psychological tests, the suitability of the candidate is decided individually;

-- illnesses and aftereffects of traumas of the nerve trunks and plexus in the presence of expressed and stable disruptions in the motor, sensory spheres and trophicity, as well as chronic illnesses of the peripheral nerves with frequent (2 times a year) exacerbations or illnesses which are untreatable. In cases of chronic but rarely exacerbating (no more than once a year) illnesses of the roots or nerve stems with a stable and complete compensation of functions between exacerbations, the question of the candidate's suitability for cosmonaut is decided on an individual basis. In case space flight is approved, a period of stable and long-term remission must be provided;

-- increased emotional-vegetative instability. In cases of good endurance of all load tests and experimental-psychological examinations, the suitability of candidates for cosmonaut-researchers is decided individually;

-- acute neuro-vascular disorders of a functional character, caused by various etiological factors (syncope, vascular collapse, etc.). If during the performance of load tests, vascular-hypotonic reactions occur which take place without loss of consciousness, it is necessary to conduct repeated examinations for the purpose of determining the adaptational capabilities of the organism. A positive examination decision in such cases, and only for cosmonaut-researcher candidates, may be reached only after hospital examination and under conditions of good endurance of all other special load tests.

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4.2. Internal illnesses.

-- residual effects after suffering from acute illnesses, exacerbations of chronic illnesses, intoxications, wounds, trauma, or surgeries;

-- infection illnesses with chronic course (brucellosis, dysentery, malaria and others);

-- expressed forms of metabolic disorders and disorders of the endocrine system, overweight.

Age	Height in cm	Optimal weight in kg	Maximally allowable weight in kg
21-30 years	160	55,0-63,0	65,0
	162	57,0-65,0	67,0
	164	59,0-67,0	69,0
	166	61,0-68,0	71,0
	168	63,0-70,0	73,0
	170	65,0-72,0	75,0
	172	67,0-74,0	77,0
	174	69,0-75,0	78,0
	176	71,0-76,0	78,0
	178	72,0-77,0	79,0
	180	75,0-78,0	80,0
31-40 years	160	55,0-63,0	69,0
	162	57,0-65,0	71,0
	164	59,0-67,0	74,0
	166	61,0-68,0	75,0
	168	63,0-70,0	76,0
	170	65,0-72,0	78,0
	172	67,0-74,0	79,0
	174	69,0-75,0	80,0
	176	71,0-76,0	80,0
	178	72,0-77,0	80,0
	180	75,0-78,0	80,0

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-- Exceeding the following norms for biochemical tests:

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1. General bilirubin - up to 1.2 mg%;
2. Sublimate test - 1.6 - 2.2 ml;
3. Thymol test - up to 12 units;
4. Formol test - negative;
5. Cholesterol - 160 - 240 mg%;
6. Free cholesterol - 76 - 116 mg%;
7. Cholesterol esters - 77 - 131 mg%;
8. Esterification coefficient - 0.47 - 0.52;
9. β - lipoproteides - 350 - 600 mg%;
10. Cholesterol in β -lipoproteides - up to 130 mg%;
11. Locitin - 200 - 275 mg%;
12. Kunkel's test - up to 35 exp. units;
13. Triglycerides -- 40 - 165 mg/100 ml serum;
14. Sucrose -- 60 - 100 mg%;
15. Resid. nitrogen -- 20 - 40 mg%;
16. Urea -- 15 - 50 mg/100 ml;
17. General protein -- 6 - 8 g%;

Albumins -- 4 - 5 gr%;

α_1 -globulins -- 0.3 gr%;

α_2 -globulins -- 0.5 gr%;

β -globulins -- 0.8 gr%;

γ -globulins -- 1.4 gr%;

18. C-react. protein -- negative;
19. Sialic test -- 130 - 220 units;
20. Antihyaluronidase - ASH -- up to 300 units;

- 21 - Antistreptolysin-0 (ASLO) - 63 - 250 units;
22. Aspartate aminotransferase - AST - 1 - 10 units;
23. Alanine aminotransferase - ALT -- 1 - 8 units;
24. Amylase -- 16 - 30 mg;
25. Alkaline phosphatase -- 20 - 50 units/l;
26. Aldolase -- 1 - 8 units; Calcium - 4.25 - 6.0 m-equiv/l;
27. Chlorides -- 98 - 107 m-equiv/l; Potassium - 4.0 - 5.0 m-equiv/l;
28. Fibrinogen -- 200 - 400 mg%; Prothrombin -- 80 - 100%.

-- disorders of the hemopoietic system, various forms of hemorrhagic diathesis, systemic disorders of the lymphatic nodes, collagenoses, allergic disorders, all forms of radiation sickness and its aftereffects;

-- all forms of lung tuberculosis;

-- chronic illnesses of the lungs, pleura, and breathing passages of a non-tuberculin etiology: emphysema, pneumosclerosis, bronchiectatic illness, pleuritis, spontaneous pneumothorax, foreign bodies in the lungs;

-- neurocirculatory dystrophy of the hypotonic and cardiac types;

-- hypertonic illness (all forms and stages);

-- illness of the coronary vessels of the heart, aorta with manifestations of coronary deficiency (including occult), atherosclerotic and myocardic cardiosclerosis occurring with insufficiency of blood circulation; all forms of chronic diffuse myocarditis; all disorders of the cardio-vascular system occurring with heavy disruption of cardiac rhythm; all forms of heart defects regardless of the state of compensation;

-- chronic illnesses of the digestive organs, as well effects of their damage or surgery with marked functional disruptions or tendencies toward exacerbation; ulcers of the stomach or duodenum, gastric or intestinal polyposis,

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chronic cholecystitis, hepatitis, pancreatitis, colitis, diverticula of the esophagus in any localization if they are large or poorly emptied and accompanied by dysphagia and other symptoms.*

-- chronic inflammatory and degenerative illnesses of the kidneys of various etiology, regardless of the degree of functional disruption;

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-- chronic joint disorders of infectious origin, on the basis of metabolic disorders or disruptions of endocrine gland functions, with expressed functional disruption with a tendency toward exacerbation.

4.) Surgical disorders.

-- surgical affection of the lymph nodes, bones, joints, genitourinary sphere, and other organs (tuberculosis, actinomycosis and others);

-- malignant tumors, as well as large benign tumors which cause a disruption in the function of organs or which hinder movement and the carrying of special equipment;

-- scars with a tendency toward ulceration which limit movement and hinder the wearing of clothing, footwear, and special equipment; after-effects of burns and frostbite with presence of trophic disorders;

-- aftereffects of injury, illness, as well as congenital defects of the bones, cartilage, muscles, tendons and joints with considerable anatomical and functional changes;

-- aftereffects of injury, chronic illnesses, changes in the form and defects in the development of the spine in the presence of functional dis-

Note: Negative examination results are reached with these illnesses in cases where the subjects have no complaints and achieve good direct results as a result of treatment.

ruption or pain syndrome - degenerative-dystrophic illnesses with expressed and moderately expressed morphological changes (deforming spondylosis, osteochondrosis, multiple -- more than 3 -- Shmorel nodes), aftereffects of compressional fractures of a vertebral body (post-traumatic deformation of the 2-3 rd degree) in the presence of radicular manifestations, pain syndrome, and disruptions in the static and dynamic function of the vertebral column; spondylolysis, aggravated by spondylolisthesis of the I degree (according to Lambl);

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-- illnesses and aftereffects of damage to the peripheral vessels in the presence of trophic disorders, as well as those expressed by disruptions in blood circulation;

-- disorders of the rectum -- prolapse of the rectum wall layers, constriction of the posterior passage, anal fistula, serious and moderately serious forms of hemorrhoids;

-- hernias -- diaphragmatic, lumbar, obturator, and ischiatic;

-- the absence, total contraction or immobility of two fingers on one hand, or of the thumb or index finger on the right hand. Considered as the absence of a finger should be: for the thumb -- the absence of the usual phalanx, for the other fingers -- the absence of two phalanges*;

* Note: Examination decisions on subjects having defects of the fingers must be made after consultation with instructors-procedure experts on the training of cosmonauts for the purpose of clarifying the possibility of working on board ship.

-- sharply expressed or recurring varicocele (hernia varicosa) after past surgery, with the presence of nodal conglomerates or pain syndrome;

-- urolithic disorders, disruption of salt metabolism (oxaluria, phosphaturia, and others), a past episode of renal colic;

-- anomalies in the development of the kidneys (number, position, structure, interrelation of the two kidneys), the ureters, the urinary bladder without disruption of the uropoietic function and the lack of pain syndrome.

4.4. Disorders of the ear, throat, nose.

-- chronic purulent disorders of the middle ear (meso- and epitympanitis), as well as persistent chronic disorders of the outer ear (eczema, dermatitis);

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-- stable unilateral reduction in hearing to the degree of perceiving whispered speech up to 1.5 m or bilateral reduction in hearing to the degree of perceiving whispered speech from 2 to 4 m, as well as with the increased auditory thresholds along the air or bone-tissue conduction of sound in the speech range of frequencies (by one or more frequencies) within limits of 30 Db or more;

-- stable, sharply expressed disruption of the barofunction of the ears and nasal sinuses;

-- increased sensitivity to vestibular irritations;

-- anosmia;

-- chronic rhinitis with the presence of stable expressed disruptions in the nasal function, allergic rhinitis;

-- purulent and purulent-polypous chronic disorders of the nasal sinuses with the presence of dystrophy of the mucal upper respiratory passages;

-- chronic disorders of the larynx, accompanied by stable disruption

of the vocal function;

- stammering and expressed ankyloglossia;

- aftereffects of traumas or illnesses of the LOR-organs, accompanied by disruptions of the respiratory, speech, or swallowing function or hindering the use of special equipment.

4.5. Stomatological disorders.

- third stage parodontosis.

4.6. Eye disorders.

- insufficiency of eyelids for fully covering the cornea, entropion and eyelash growth toward the eyeball, causing eye irritation; ectropion, drooping of the upper eyelid (ptosis), adhesion of the eyelids between each other or with the eyeball on at least one eye which disrupts the functioning of the eye;

- chronic disorders of the eyelid margins and conjunctivitis which is resistant to treatment;

- persistent lacrimation due to disorders of the lacrimal ducts;

- chronic disorders of the membranes of the globe of the eye of an inflammatory or degenerative character;

- separation of the retina;

- glaucoma;

- atrophy of the optic nerve;

- stable reduction in dark adaptation;

- paralysis or stable paresis of the locomotory nerves of the eyelids or the eyeball;

- concomitant squint over 10° ;

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- visual acuity without correction below 0.6 for each eye;
- anomalies in refraction above $+2.0^D$ and -2.0^D , astigmatism of any type above 1.5^D ;

- paralysis or spasm of accommodation on one or both eyes;
- presbyopia of 2.0^D or higher;
- anomalous trichromasia of type "A" and "B".

4.7. Skin and venereal diseases.

- widespread, difficult to treat skin diseases accompanied by general upsets, leprosy, tuberculosis, pemphigus, eczema, psoriasis and others;
- syphilis.

4.8. Functional deviations.

- reduced stability of the organism to the effect of moderate degrees of hypoxia;
- reduced stability of the organism to the effect of radial accelerations;
- reduced stability to change in body position;
- Lowered resistance of the body to physical loads;
- Lowered resistance of the body to the effects of short-term weightlessness;
- Unfavorable individual-psychological peculiarities of personality.

4.9 Female diseases.

- Benign and malignant neoplasms of female sex organs;

- Uro-genital and genitointestinal fistulas, and also the results of a peroneal tear with the disturbance of the sphincter;
- Prolapse or lowering of female sex organs;
- Incorrect positions of uterus and defects in the development of female sex organs, accompanied by disorder in menstruation (after investigation in the therapeutic institution);
- Commissural and cicatricial changes in the peritoneum, adhesions or atrophic changes in the tissues with the disturbance of the anatomical-topographical relationships both as a result of former inflammatory processes, or post-operative, and secondarily, accompanied by a disorder in activity of sex organs (disturbance of menstrual function, etc.);
- Acute inflammatory diseases of the uterus, fallopian ducts, ovaries, pelvis peritoneum and cellulitis of serous or purulent nature, and also chronic inflammatory diseases with frequent aggravations;
- Persistent disturbances of the menstrual function of different types (menoragia, hypomenorrhea, amenorrhea, dysmenorrhea, acyclic hemorrhages, etc.).